Bound states in two dimensional graded photonic crystal at Γ point
A new approach to inhibit spontaneous emission

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When the photonic band in the light cone (A in the figure) was excited, the photon will propagate in the crystal but this photon can tunnel to the photon in air. The direction of this photon in air is given by $\cos\theta = k_B / k_L$ where k_B is the momentum of photon in the band, k_L is the momentum in air and θ is the angle from perpendicular direction. At Γ point (B) photon will move in the crystal with a very slow group velocity and also escape to the perpendicular direction. Then if bound state in the gap was fabricated (C), this photon cannot move in the crystal and all the light should go out from the crystal to the perpendicular direction.

The field intensity was calculated by the multiple scattering theory in the graded photonic crystal in which lattice constant changes gradually. We confirmed the existence of bound states at Γ point.

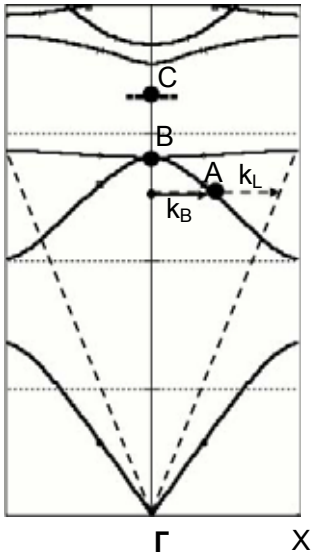

Fig.1. Typical band structure of the square lattice photonic crystal. Solid lines are the light lines.